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Equatorial Spots.—The motion of both S. and N. equatorial spots varied considerably during the course of the apparition, a decided acceleration of S. equatorial spots between longitudes 0° and 210° ± (System i.), and of N. equatorial spots in almost all longitudes, setting in towards the end of January. There was a very large difference of rate—amounting to over 14 seconds per rotation—between the two portions of the equatorial current.

Description of an Equatorial Reflecting Telescope driven by a Hydraulic Ram. By T. E. Heath.

The drawing shows the optical axis of the telescope pointing to the pole.

A, reflecting telescope ($8\frac{1}{2}''$ mirror) in square teak tube.

B, cast-iron right ascension circle 21″ dia., having a groove formed round periphery.

C C, cast-iron A frames bolted to R.A. circle, carrying declination axis, and allowing telescope to be set at any declination from 40° S. to 90° N.

D, cast-iron circle, carrying steel balls upon which the R.A. circle revolves.

E, cast-iron base-plate, to which D is bolted.

F, declination axis.

G, rope, which fits bottom of the groove in R.A. circle and is kept taut by a tension pulley carried by a lever H which is pulled by a spiral spring I. The rope passes over guide pulleys K, and one end of it is attached to the bottom of a hollow brass hydraulic piston L and the other end to a cross-bar M, which is supported at a sufficient height above the piston L by the pillars N. O is a brass hydraulic cylinder, 8″ dia. and 10″ high. (The piston L has a cup-leather below it.) The supply of liquid to the cylinder is regulated by a valve P (which is one of those sold to regulate the supply of oxygen from a cylinder). The valve is operated by a lever Q, to one end of which is attached a cord R and to the other end a cord S. The cords R and S are led over suitable guides to either end of a bar T, which hangs from the roof of the observatory, conveniently near to the observer.

The telescope is balanced by about 10 lbs. of lead attached to the lower end of the tube, so that it will stay at whatever declination it is set, and so that the force required to move it in R.A. is everywhere approximately the same.

I find that if the rope G be so large that it covers the bottom of the groove in the R.A. circle, but not so great that it grips the sides, and the spiral spring be an ordinary "door pull," then the friction will not prevent the observer easily setting the telescope on any required star, but will be sufficient when he lets go the telescope to cause the R.A. circle to revolve.

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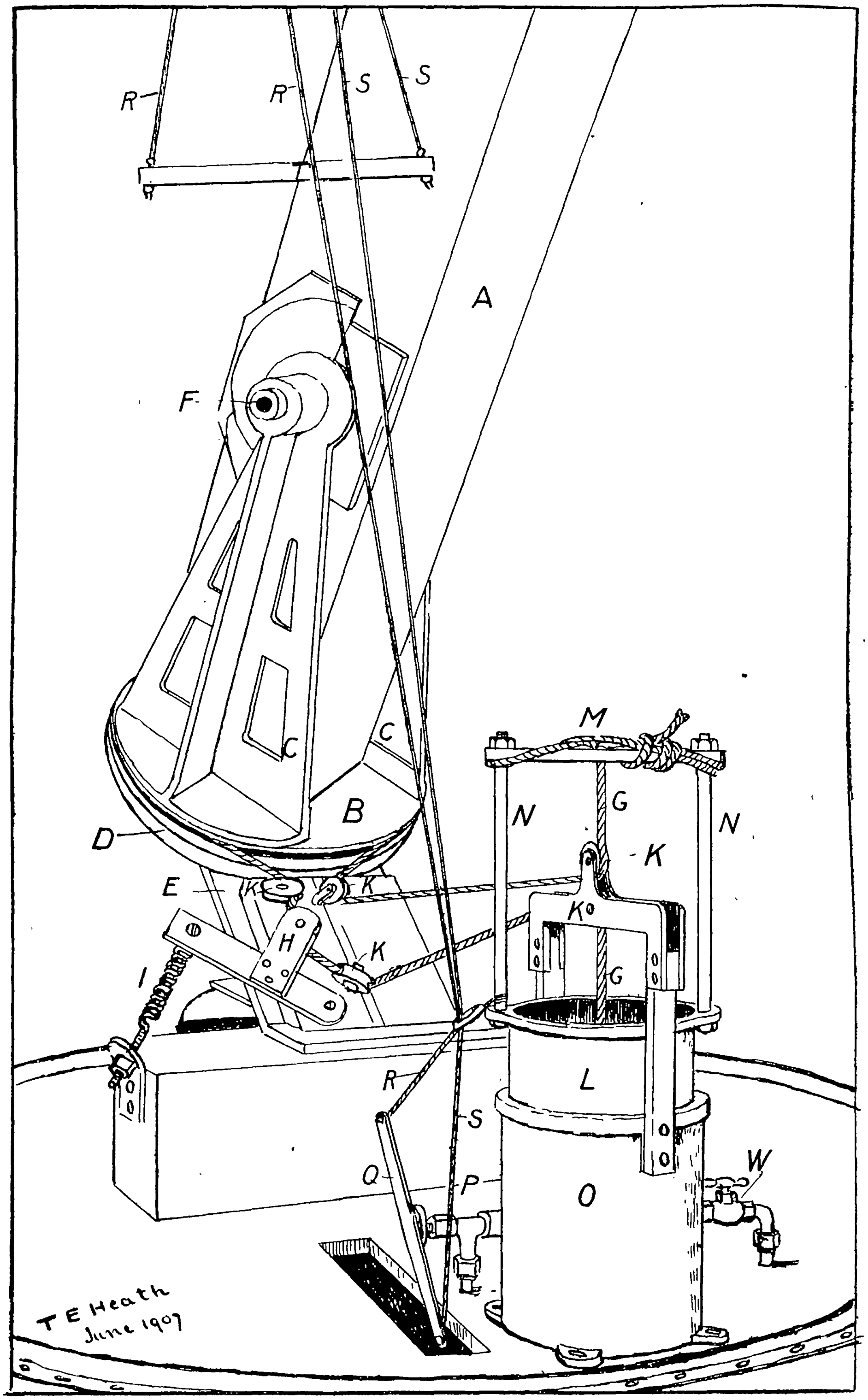

Equatorial Reflecting Telescope driven by a Hydraulic Ram.

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In practice, the liquid is allowed to flow into the hydraulic cylinder all the time the observer is working. He shifts, as desired, from star to star, and the telescope follows automatically. The hydraulic cylinder is large enough to run the telescope for 2½ hours (it could be made longer if desired). A relief valve marked W is opened, and by standing on the piston it is pressed down, ready for a fresh start. This takes about one minute. It takes less than five minutes from the time I leave the house to the time the telescope is following an easily visible star.

At present I use the water direct from the town supply. This does well enough for observing, as it is quite easy, by means of the bar T, to regulate the supply of water to suit the varying pressure. For photographic work, it would be desirable to draw the snpply of liquid from a high tank, in which the level is kept constant by a ball valve, and it would be preferable to use glycerine or something not easily frozen. (2½ hours' supply is about one gallon.)

On May 27 I found Jupiter with the circles at 5·50 p.m., and followed it till 9·5 p.m., when it set behind trees. I had several times to vary the supply of water, but sometimes the telescope would run truly for 30 minutes. I had, of course, to empty the cylinder once. The motion is absolutely steady. You can get an even sweep in either direction by turning on more or less water. Then, when a suspected object comes across the field, you can go slow and stop it in the middle.

The observatory runs round upon a circular railway attached to the floor. In each corner, forming part of the structure, is a triangular cupboard. Thus the eyepieces, etc. are always handy.

The cost was approximately as follows:—

Mirror, eyepieces, tube, etc., £35; the equatorial stand, £10; the hydraulic clock, £6; and the observatory £10. This, of course, does not include my time, but I did not do any of the manual work.

P.S.—I have improved the working of the inlet valve by screwing a wooden sheave, 9 in. diameter, to the outer face of the lever Q. The cords R and S are fastened to the sheave and wound round it before being taken to the observer.

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The Origin of certain Bands in the Spectra of Sun-spots.
By A. Fowler.

In the spectra of sun-spots there are numerous short hazy lines, termed "band lines" or "umbra lines," which have not hitherto been traced to their source. They are especially notable in the neighbourhood of *b*, and on the more refrangible side of this group, and the positions of some of them have been estimated by various observers, including Maunder, Cortie, Hale, Newall, and myself. The close resemblance between these lines and the structure lines of a banded spectrum seen under high dispersion led me to make numerous experiments on banded spectra during 1905 and 1906, with the hope of identifying the substance producing them, but the results were then entirely negative.* I have lately discovered, however, that a great number of these lines really form part of a fluted spectrum, and are to be accounted for by the presence of a compound of magnesium and hydrogen in the umbræ of spots. Pending a more complete comparison, which will take a considerable time, the present preliminary note may be useful to those engaged in the investigation of spot spectra.

The magnesium-hydrogen flutings were the subject of an extended research by Liveing and Dewar many years ago,† when it was clearly shown that hydrogen and magnesium were together involved in their production. Independent evidence as to the existence of a compound of these two elements has since been obtained,‡ and there need be no hesitation in attributing the flutings in question to the chemical combination "magnesium hydride."

The brightest of these flutings, or rather groups of flutings, begins in the green near 5211 and fades off towards the violet, while there is another group beginning near 5620, and another on the violet side of H_β. In a series of experiments made by Mr Howard Payn and myself,§ they appeared very strongly in the spectrum of the arc between magnesium poles in a vessel exhausted to a pressure of a few millimetres, the hydrogen necessary for their formation being liberated in sufficient quantity from the heated poles. A re-examination of the photographs obtained in this way was suggested by a second reading of Mr Newall's account ¶ of his observations of a fluting in spot spectra beginning at 5210·2 or

* *Trans. Int. Solar Union*, vol. i. p. 217 (1906).
† *Proc. Roy. Soc.*, vol. xxxii. p. 189 (1881).
‡ Winkler, *Ber. Deutsch. Chem. Gesell.*, vol. xxiv. p. 1973 (1891).
§ *Proc. Roy. Soc.*, vol. lxxii. p. 254 (1903).
¶ *Monthly Notices*, vol. lxvii. p. 170 (1906).

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